6100L

Power Amplifier

OPERATION MANUAL

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WARNING ***HIGH RF VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT.*** *All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.*

DO NOT USE ANY CFC (CHLOROFLUOROCARBON) SOLVENT IN THE MAINTENANCE OF THIS PRODUCT. In recognition of our responsibility to protect the environment, this product has been manufactured without the use of CFC's. The no-clean flux now used in all soldering operations may leave a small inert residue which will not affect the performance of the product. The use of CFC's for cleaning or maintenance may result in partial liquification of the no-clean flux residue, which will damage the unit and void the warranty.

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Operation Manual Order Number: 1020-000
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Warranty

ENI warrants to the original purchaser for a period of one year from the date of delivery, each instrument to be free from defects in materials and workmanship. For a period of one year, ENI will, at its option, adjust, repair, or replace defective parts, without charge to the original purchaser, so that the instrument performs according to its specifications.

When warranty service is required, the instrument must be returned, transportation prepaid, to the factory or to one of ENI's designated service centers. If, in our opinion, the instrument has been damaged by accident, unreasonable use, buyer-supplied software or interfacing, improper site preparation or maintenance, or abnormal conditions of operation, repairs will be billed at standard rates. In this case, an estimate will be submitted before the work is started.

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Service And Technical Assistance

For Service or Repair contact the closest Customer Service Department with the following information:

- Model and serial number
- Purchase order number
- Detailed description of malfunction
- Your company's "Bill To" and "Ship To" address

You will receive a RMA (Return Materials Authorization) number, the warranty status of the unit to be returned and estimated repair charge, if any. The RMA number is your authorization number. Please type this number on your purchase order and shipping label. After ENI receives the unit, a firm quote and estimated date of completion will be given.

For Technical Assistance for your particular application, contact the nearest ENI Sales and Service Center. The following information will help us provide you with prompt and efficient service:

- All of the information contained on the unit's name plate.
- Names and telephone numbers of important contacts.
- Detailed description (i.e. physical damage and/or performance anomalies, quantitative and/or qualitative deviation from specifications), including miscellaneous symptoms, dates and times.
- The environment and circumstances under which the issue developed
- Supporting test data and/or records that can be provided.
- Any previous, related conversations and/or correspondence with ENI.

Sales & Service Locations

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AUSTIN, TX	8403 Cross Park Drive Suite 3A Austin, TX 78754	Tel: (512) 339-8949 Fax: (512) 339-8940
UNITED KINGDOM	Mundells Court, Welwyn Garden City Hertfordshire AL7 1EN England	Tel: (0707) 371 558 Fax: (0707) 339 286
GERMANY	Sielminger Str. 63 D-70771 Leinfelden- Echterdingen (Stetten) Stuttgart, Germany	Tel: (0711) 947 70 0 Fax: (0711) 947 70 25
JAPAN	541 Aoyogi Kunitachi Tokyo 186 Japan	Tel: (0425) 229 011 Fax: (0425) 222 636
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PRODUCT MANUAL REVISION CONTROL FORM

Title: 6100L Operation Manual	Part #: 1020-000	Final Assy #: 6100L-01
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General Information

Introduction

The 6100L broadband RF power amplifier system is a rugged source of RF power for automated test systems, broadband communications testing, communication work and general laboratory use. With Class AB linearity, automatic level control, exceptional meter accuracy and standard IEEE interface, the 6100L redefines the state-of-the-art for a full featured, solid-state UHF amplifier.

The 6100L produces 100W of linear RF power output over an instantaneous frequency range of 400 to 1000MHz. Small signal gain is rated at 51dB nominal with ±2.0dB maximum flatness in the ALC (Automatic Level Control) 'OFF' mode. In the ALC 'ON' mode, power output level is controlled by the front panel power adjust knob or the remote interface over a 30dB range. The internal ALC loop can be AM and pulse modulated through the front panel modulation input port.

The amplifier will withstand a +13dBm RF input signal ($1V_{rms}$) and is fully protected against RF input overdrive, out-of-band operation, output load VSWR and overtemperature. Load VSWR protection folds back the forward power above 1.5:1VSWR without causing a power cutoff. The 6100L amplifies the inputs of CW, AM, Pulse, FM and phase signals with -20dBc minimum harmonic distortion and provides unconditional RF stability within the specified performance ratings.

The amplifier's automatic level control (ALC), operating through a servo loop feedback system, maintains RF power output flatness of less than ±0.5dB. For easy link-up to ATE (Automatic Testing Equipment) components the 6100L is equipped with a standard IEEE 488.2 interface for remote computer control.

A µP (micro-processor) controlled alphanumeric vacuum fluorescent display clearly indicates forward, reflected and set power in Watts or dBm with a resolution of ±5W or 0.5dB. Bright LEDs on the front panel indicate operating parameters such as ALC On/Off, RF On/Off, Modulation On/Off, Watts/dBm, Remote Enable, and Fault Reset.

The 6100L is a forced-air cooled system (front panel in, rear panel out) and the integral power supply are conservatively rated to permit operation over a wide range of temperature and AC line conditions. For testing applications the 6100L incorporates RFI shielding to restrict RF emissions from the amplifier.

The amplifier's modular, solid-state design facilitates maintenance and service. Although packaged for bench mounting, the unit may be rack mounted with the optional rack-mounting brackets.

The 6100L Broadband Power Amplifier is backed by ENI's one-year warranty and worldwide network of service and technical support. Rugged, compact and reliable, the 6100L provides the ultimate in flexibility and versatility for broadband testing and general laboratory use.

The amplifier has been designed in a modular fashion to make simple field servicing possible. The 6100L contains the following modules:

RF Section consists of the following PC boards and assemblies:

- Filter/Attenuator/Driver
- IPA1 (Intermediate Power Amplifier #1)
- IPA2 (Intermediate Power Amplifier #2)
- PA (Power Amplifier)
- Frequency Correction

Power Sensor Assembly consists of:

- Dual Directional (Forward and Reverse) RF Coupler
- Dual Detector (Forward and Reverse) with Integrated Circuit Temperature Monitor (incorporated within detector housing)

Control Section Assembly consists of the following PC boards:

- Analog Interface (ALC/VSWR Protection Circuits)
- Control (Micro-processor and Memory)
- IEEE-488 (Includes RS-232/422 Interfaces)

Front Panel Assembly consists of the following PC boards and assemblies:

- LED Status PC Board
- Push-button PC Board
- Vaccuum Fluorescent Display
- Power Level Optical Encoder

Power Supply Assembly consists of:

- AC Power ON/OFF Switch and the Main +28VDC Power Supply

Fan Assembly with Regulator PC board consists of:

- The Fan Assembly cools the RF amplifier system and consists of three DC fans supplied from the Main +28VDC Power Supply.
- The Regulator PC board inputs +28VDC from the Main Power Supply Assembly and outputs +5VDC and ±18VDC for system operation.

This manual is divided into three sections. Please refer to the following descriptions to help you locate the information you need.

Chapter 1	Deals with precautionary details. Please read this section if you are unfamiliar with the 6100L or ENI's warranty procedures.
Chapter 2	Tells you how to install and power-up the system.
Chapter 3	Describes operational details of the 6100L. A formal specification and a system block diagram are both located at the end of this section.

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Chapter 1

Safety

It is essential that the user become thoroughly familiar with the contents of this manual prior to using the 6100L. If used properly, the information contained in this manual will not only promote reliable generator performance but will also encourage a safe operating or service environment for all individuals.

1.1 Labels

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

1.1.1 Important Operating or Maintenance Cautions

CAUTION !

The caution label is used in this manual, to caution the reader to important operating or maintenance instructions which could adversely affect the equipment reliability.

1.1.2 Shock Hazard Warnings

WARNING

The warning label is used in this manual to warn the reader of a procedure or practice which could result in personal injury if not followed carefully.

1.1.3 Service

CAUTION !

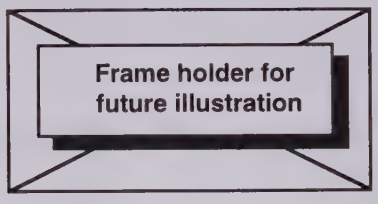
WARNING

ENI is responsible for safety, reliability, and performance of the equipment only if:

- *Assembly operations, extensions, readjustments, modifications, or repairs are carried out by authorized personnel.*
- *The electrical installation is made in accordance with the installation instructions provided and the room in which the equipment is installed complies with the environmental requirements.*
- *The equipment is used in accordance with the instructions for use.*

1.1.4 Name Plate

The 6100L can be identified by a name plate at the rear of the unit and contains the following information.



6100L Identification Label

Figure 1.1.4

A. **Manufacturer**:

ENI

Rochester, NY USA

B. **Model**:

The assembly number which uniquely identifies product configuration is contained on this line.

C. **Serial #:**

This line contains a number which is sequentially assigned as the product is manufactured.

D. **Revision:**

The revision letter identifying product configuration is contained on this line. Revision A is the initial revision level.

E. This line contains customer name and customer identification number.

F. **Date:**

Proper identification of the date of manufacture is contained on this line.

1.2 Recommended General Practices

1. Never work alone.
2. Operating personnel must be proficient in the following areas:
   - Knowledge of all local circuit breaker locations and certainty of clear access to those locations
   - Manual operation of all local circuit breakers
   - Cardiopulmonary Resuscitation (CPR)
   - Knowledge of all local emergency telephone numbers and the location of the nearest telephone
   - Knowledge of proper operation of the nearest Class ABC fire extinguisher and certainty of clear access to it.
3. Always seek immediate medical attention if you incur an electrical shock, regardless of the absence of any symptoms.
4. Never use equipment that is mechanically unstable.
5. If RF POWER OFF is desired, confirm for yourself that the power is off. Never rely on someone else's word.
6. Confirm for yourself that the RF ground return is connected. Never rely on someone else's statement.
7. Never wear loose clothing or jewelry of any kind.
8. Service personnel must:
   - Remember to ground their forearms before touching components with their hands
   - Never work on live circuits
   - Always keep one hand behind their back.

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Chapter 2

System Installation

2.1 Initial Inspection

2.1.1 Mechanical Inspection

If damage to the shipping carton is evident, request the carrier's agent be present when the unit is unpacked. Check for equipment damage and inspect the cabinet and panels for dents and scratches.

2.1.2 Claim for Damage

Please notify ENI directly or your authorized ENI representative if the (Product) is mechanically damaged or fails to meet specifications upon receipt. Retain our shipping carton and packing material for the carrier's inspection as well as for subsequent use to return the unit should this become necessary.

2.1.3 Packaging for Reshipment

Whenever possible, the original shipping carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard carton is used, it should be at least 200 lbs. test material.

Use shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container: **FRAGILE ELECTRONIC INSTRUMENT.**

CAUTION ! ***Drain water before shipment.***

2.2 Installation Requirements

2.2.1 Rack Mounting

The unit is provided with optional EIA 19 inch or JIS standard rack-mounting ears and slides. Front panel rack-to-ear mounting hardware must be customer supplied.

2.2.2 Cooling and Ventilation

The 6100L is air cooled by three internal fans. The front panel of the amplifier allows air intake. Exhausted air is removed through the back panel. Consideration must be given to the amplifier's installation so as to not impede the supply or flow of air to the amplifier system.

To guarantee top amplifier performance a minimum clearance (2" or 5cm) is required between the unit and cabinet walls. This ensures adequate air flow for the entrance of cooling air to the back of the unit. Exhaust ports, located on the unit's back, should be free from obstruction. To reduce potential overheating, do not allow exhausted warm air to recirculate to the front of the unit.

Maximum Ambient Temperature	45°C

Note: *Inadequate air flow will result in an overheat condition. The 6100L's RF power will automatically shut off until normal internal temperatures are restored. The front panel vacuum fluorescent display will indicate 'RF OVERHEAT' if this condition occurs (see Section 3.1.2). The fan must be operational at all times to ensure top performance of the 6100L.*

2.3 Powerline Voltage Selection

The 6100L is designed for operation from a single-phase, 3-wire, 47-440Hz, 1400VA maximum AC line from 90 to 132VAC or 175 to 264VAC line-to neutral or line-to-line. Voltage selection is required.

CAUTION !

Before attempting to change the 115/120 internal main power supply jumper wire, always unplug the AC cord from the AC line. Otherwise, personal injury could result.

WARNING

Be sure the 115/220V internal main power supply jumper wire is set to the proper line voltage before AC power is applied.

The following procedure outlines how to change the line voltage setting of the 6100L:

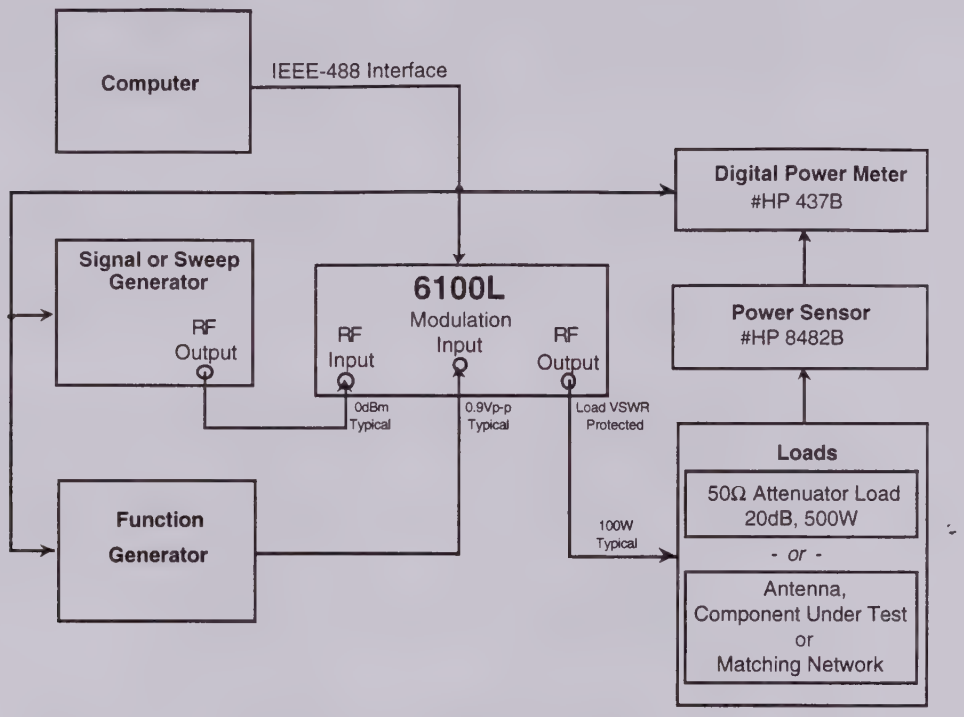
1. Ensure that the unit is not connected to AC power.
2. Remove the sixteen screws holding the top cover in place.
3. Check the main power supply rear terminal strip (yellow protection cover) and locate the blue jumper wire between taps 1 and 2. If the amplifier is wired for 115VAC operation you will find a blue jumper wire connection. For 220VAC operation this jumper wire will not be present.
4. To change the line voltage setting either connect or disconnect taps 1 and 2 as required.
5. Replace the protective yellow terminal strip cover and the amplifier's top cover.

2.3.1 Power Cable

The 6100L RF amplifier is equipped with a three prong IEC 320 (16A) male type connector for connection of AC power input. It is also supplied with a mating 115VAC line cord, ENI Part No. #411009. A three conductor, #14AWG cable (or larger conductor) is required.

2.4 System Interconnection

The following diagram shows a typical interconnection of the 6100L to a system:



Typical System Interconnection with a 6100L
Figure 2.4

The remote control connection allows a computer or external control unit to adjust and read back power via the IEEE-488/RS-232/RS-422 interface connector (see Section 3.2). The RF output connector is made to a device such as an 50Ω 20dB, 500W attenuator load.

2.5 System Check

The following items should be checked before applying power for the first time:

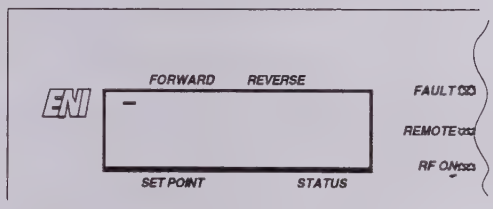
1. Check for any physical damage that could affect safety. For instance, a dent could indicate that internal components could have shifted and could also cause a short circuit.
2. Make sure that the front panel AC power switch is in the off position (handle down).
3. Guarantee that the AC power cable is connected to a grounded AC outlet.
4. Terminate the RF OUTPUT port of the power amplifier system to a suitable 50Ω 20dB, 500W attenuator load. Connect a power meter (e.g. HP #437B Digital Power Meter and HP #8482B Power Sensor) to the attenuator load output.
5. Connect a signal/sweep generator to the RF input port. Adjust the level to 'OFF' at 0dBm level.
6. Turn AC power on (handle up). Follow the *Initial Turn On Procedure,* Section 2.6.

2.6 Initial Turn On Procedure

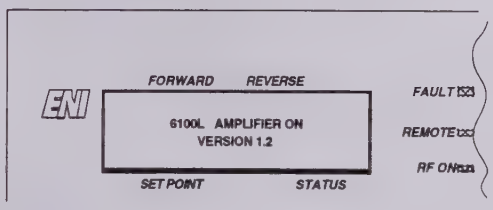
The following procedure outlines how the 6100L should react as power is applied for the first time. Note that the 6100L must be allowed a thirty minute warm-up to guarantee display resolution.

1. Make sure that the AC power input is correctly wired and that the supply voltage matches the voltage for which the amplifier has been configured (see Section 2.3.1).
2. Set signal/sweep generator RF output level to 'OFF' at 0dBm.
3. After reviewing Figure 2.4, connect the 6100L RF output port to a 50Ω, 20dB 500W attenuator load and digital power meter. Calibrate the attenuator and digital power meter for frequency variation over the operating frequency range of 400-1000MHz.
4. Turn the AC POWER switch (handle in up position) on.

   The cursor will show on the VF (Vacuum Fluroescent) display:



   Next, the VF display reports the current software version level and states that the 6100L is on:



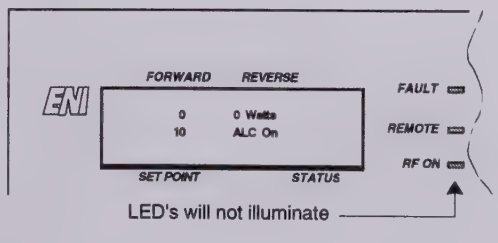
Note: *Should a fault be indicated (red 'FAULT' LED illuminates), refer to Faults, Section 3.1.2 for further information.*

5. Make the following push-button settings:

ALC	ON	Green LED push-button illuminates
ON/OFF (RF POWER)	OFF	
MOD	OFF	
WATTS/dBm	WATTS	
REMOTE ENABLE	LOCAL	
RF POWER Knob	1.0	

The settings above will produce the following display changes:

Note: See Section 3.1.4.1 for a complete description of ALC push-button switch functions.

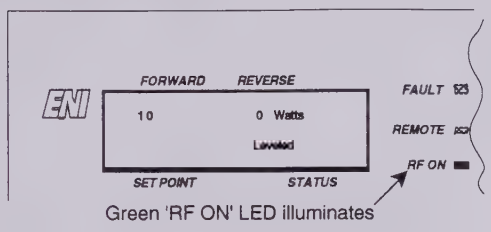


2.6 Initial Turn On Procedure, Continued:

6. Make the following push-button settings:

ON/OFF (RF POWER)..... ON Green 'RF ON' LED illuminates
Signal/Sweep Generator..... ON
(at 0dBm level)

The settings above will produce the following display changes:



Green 'RF ON' LED illuminates

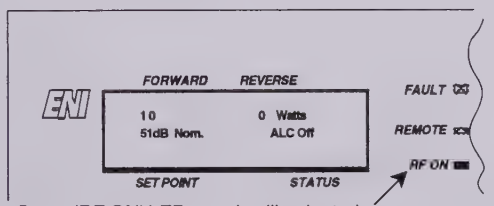
The external power meter should indicate 10W RF power output. Adjust the front panel RF POWER level knob to the desired power level up to rated power output over the specified 400-100MHz frequency range.

Note: *The attenuator load and digital power meter must be calibrated for errors due to frequency. Note also that the power output will change with frequency as indicated on the external power meter. This change should not be more than ±12% (±0.5dB) across the band of operation.*

7. Make the following push-button settings:

ALC.....OFF
ON/OFF (RF POWER).....ON
MOD .....OFF
WATTS/dBm..... WATTS
REMOTE ENABLE.....LOCAL
RF POWER Knob.....(Not Active)

This illustration reflects the ALC 'OFF' mode produced by these settings.



Green 'RF ON' LED remains illuminated

Note: *The 6100L is set up as a linear amplifier with a minimum power output of 100W. The RF output level, as observed on the front panel display and the external power meter, is controlled by varying the RF input level (less than -5dBm) from the signal/sweep generator.*

The initial startup procedure is now complete.

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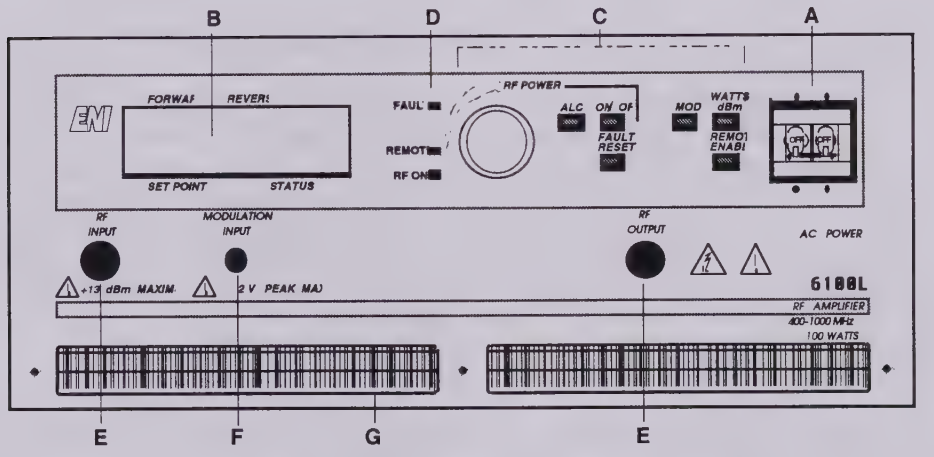
Chapter 3

6100L Operation

3.1 Front Panel

It is important to understand the function of each device before attempting operation. Figure 3.0 illustrates all of the front panel devices; text throughout the remainder of this section provides a functional description for each device.



6100L Front Panel
Figure 3.0

The 6100L front panel is provided with:

- Covered, non-accidental AC POWER switch ..... A
- Two line, forty character vacuum fluorescent display for operational and status monitoring ..... B
- RF POWER (power level knob) and six push-button switches for primary control C

ALC *..... FAULT RESET ..... WATTS/dBm .....
ON/OFF (RF) ..... MOD * ..... REMOTE ENABLE *
..... (Modulation On/Off)

- Three LED indicators for status monitoring.....D

FAULT .....REMOTE .....RF ON
(red) ..... (green) ..... (green)

- Two connectors ('N' female) for RF INPUT and OUTPUT .....E

Note: *The RF INPUT and RF OUTPUT connectors may be located on the back of the 6100L if you ordered the 6100L with the connectors on the rear.*

- Connector ('BNC' female) for MODULATION INPUT..... F
- Air intake vents.....G

Note: * *Identifies push-button switches which contain LED's, incorporated to provide annunciation of specific amplifier conditions (operating parameters).*

3.1 Front Panel Devices

3.1.1 AC POWER (switch)

The main front panel AC Power switch provides on/off AC power control. The RF amplifier system is on when the switch handle is in the up position. This ON/OFF switch is clearly labeled on the switch handle and is protected by a plastic cover to guard against accidental tripping of the switch through physical contact.

Note: *The AC POWER input line is protected by internal fuses located within the +28V Main Power Supply PS1. These internal AC input fuses will open if a catastrophic failure occurs in the power supply converter section. For this reason and for safety agency requirement compliance, a non-user, replaceable fuse has been used. Should the power supply internal AC input fuse open for any reason, the supply should be sent back to ENI for repair or replacement.*

3.1.2 Vacuum Fluorescent Display

The 6100L display consists of two lines of 20 dot matrix characters which are used to display the present operating status of the amplifier. Each field in the front panel display is marked to indicate its purpose as follows:

Field	Description
FORWARD	Indicates the RF amplifier's forward RF power output in Watts or dBm as measured at the front panel RF output port connector. Power indication occurs only when RF power is present at the RF output port connector. See Note, below.
REVERSE	Indicates the amplifier's reverse RF power in Watts or dBm as reflected from the external load and is measured at the front panel RF output port connector. See Note, below.
SET POINT	Indicates the RF power in Watts or dBm as set by the front panel power level knob. The RF ON/OFF push-button switch must be in the RF 'OFF' mode to adjust the SET POINT power level. When the amplifier system is placed in the RF 'ON' mode the SET POINT field will remain blank.
STATUS	Provides information pertaining to normal operating and possible fault conditions of the amplifier system. The normal operating conditions are discussed in *ALC Push-button Switch,* Section 3.1.4.1. Possible fault conditions are discussed in subsequent paragraphs.

Note: *A low-pass filter, which operates under remote interface control, will change the forward and reverse power meter from an average to a peak responding meter. This significantly increases the speed at which forward and reverse power meter data readings can be made. (See Section 3.2.4.4, IEEE-488 Command Fn and Table 3.2.5.3.3, RS-232/422 Command FLT).*

3.1.2 Vacuum Fluorescent Display, Continued:

Two types of faults (hard and soft) may occur in the 6100L.

Hard Faults

A hard fault will cause the red 'FAULT' LED to illuminate and force RF power off.

To clear a fault, first identify the cause of the fault and attempt to correct the problem. Then clear the fault by using one of the two following methods. If LOCAL operation is selected, clear the fault through the front panels FAULT RESET push-button (see Section 3.1.4.5). If REMOTE operation is selected, use either the Serial RS-232/RS-422 or the IEEE-488 Interface to clear the fault (see Sections 3.2.4 and 3.2.5 respectively).

If the problem was corrected the fault will clear and returns the unit to the same condition prior to the fault. RF power output, however, will remain off. If the problem was not corrected the fault still will not be cleared.

Note the following:

- Should an 'RF OVERHEAT' fault occur, RF will return to its original condition if the fault is cleared via the external remote interface.
- The FAULT RESET button will turn RF off any time it is pressed while the unit is in LOCAL mode. This is true even if a fault is not present.

Hard Faults

RF OVERHEAT
METERING FAULT
INT RAM FAULT
EXT RAM FAULT
ROM FAULT
LINK TIMEOUT
IIC FAULT
WATCHDOG FAULT

Soft Faults

A soft fault indicates an abnormal condition which will be reported in the STATUS field or may be requested through the external remote interface. This fault will not cause the red 'FAULT' LED to illuminate or the RF to turn off. This is intended as an indication only.

Soft Faults

MAX REVERSE

3.1.3 RF Power Control Knob

The RF power level adjustment knob is an optical encoder type which allows adjustment of the RF output power when operating the amplifier system only in the ALC 'ON' mode. The RF power level (at the RF output port) increases when the knob is rotated in a clockwise direction up to rated power. Conversely, the power level will decrease when the knob is rotated in a counter-clockwise direction.

Typically, twenty revolutions of the RF power level knob (Revolution = 0.8mW per step) will cause the RF power output to change from minimum to maximum rated power output with a minimum control range of 30dB.

The RF power level control knob allows setting of the RF output level as displayed on the front panel display SET POINT field when the 6100L is operating in the RF 'OFF' mode.

Note: *The SET POINT field will blank out when the 6100L is operated in the RF 'ON' mode with the actual power output level at the RF output port now being displayed in the FORWARD field.*

3.1.4 Push-button Controls

With the exception of the ON/OFF (RF POWER) push-button, the six push-button switches are software programmed to remain in the same set position (before power turn-off), and to remain in that position upon each power-up cycle unless that position is changed by the operator.

The (RF) ON/OFF push-button switch will come up in the RF 'OFF' mode upon each power-up regardless of which mode of operation it was in prior to shut-down.

Descriptive text for each push-button switch is presented throughout the remainder of this section.

ALC Push-button Switch

The ALC push-button switch is used to enable the ALC (Automatic Leveling Control) loop. A green LED on the push-button switch will illuminate to indicate the active 'ON' mode. In the ALC 'ON' mode the 6100L's RF output leveled flatness will be ±0.5dB over the 400-1000MHz frequency range. The front panel status field will display the following mnemonics:

Push-button Switch Position:	Status Field Displays:
ALC 'OFF', RF 'ON/OFF'	51dB Nom. ALC Off
ALC 'ON', RF 'OFF'	ALC On
ALC 'ON', RF 'ON' Insufficient or no RF input level for RF output level.	UNLEVELED
ALC 'ON', RF 'ON' Sufficient RF input level for RF output level.	LEVELED

The UNLEVELED/LEVELED status display indicator is active only when operating the amplifier system in the ALC 'ON' and RF 'ON' modes. This status indicator will indicate the amplifier system lacks sufficient RF input level to maintain a specified ALC 'ON' flatness. The UNLEVELED/LEVELED status indicator is only useful when the amplifier is used in a non-sweep operation (CW only).

In the ALC 'OFF' mode, the amplifier can be used as a standard linear RF amplifier up to rated power output. Beyond its specified rated power output, internal circuits will limit the power output.

3.1.4 Push-button Controls (Continued)

RF Power ON/OFF Push-button

This push-button switch provides on or off control of the RF power output. Pressing the push-button switch to the 'ON' mode will toggle the RF output power between zero and the power set point. The green LED marked 'RF ON', located to the right of the display, will illuminate to indicate the active mode.

In the 'OFF' mode the green 'RF ON' LED indicator is not illuminated. The amplifier's internal pin attenuators are positioned at maximum attenuation (-40dB minimum with respect to rated power output level). This is useful when zeroing a power meter.

Upon each power-up cycle the amplifier system will always position itself automatically to the RF 'OFF' mode.

MOD Push-button

Depressing the MOD (Modulation) push-button switch positions the amplifier system into a Modulation 'ON' or 'OFF' mode. A green LED indicator light on the push-button switch will illuminate to indicate the active mode. This push-button switch is only functional when the amplifier system is operated in the ALC 'ON' mode. In the ALC 'OFF' mode the MOD (ON/OFF) push-button is inactive.

The RF output signal can be AM, pulse and squarewave modulated by the 6100L internal ALC (Automatic Level Control) loop through the front panel modulation input port as long as the modulation frequency is within the closed-loop bandwidth of approximately 25kHz.

The modulation bandwidth is limited by the ALC closed-loop bandwidth. For wideband AM modulation requirements, operate the 6100L in the ALC 'OFF' mode and modulate the RF input port using the signal source. The modulation bandwidth is limited by the amplifier RF bandwidth.

Note: *The modulation input port is DC coupled. A DC voltage from 0 to ±1.0VDC will result in a RF power output level variation from 0.1 (0VDC) to 100W (+1.0VDC). The RF output power level must be adjusted for different modulation formats. The amplifier system cannot deliver more than 100W rated CW/PEP (Peak Envelope Power) RF power output to the load.*

3.1.4 Push-button Controls (Continued)

WATTS/dBm Push-button

The Watts/dBm push-button switch will display either Watts or dBm in the upper right-hand corner of the vacuum fluorescent display.

The forward power meter is calibrated in Watts/dBm with respect to the RF power output port connector using a Hewlett Packard #HP 437B power meter and

#HP 8482B power sensor as a standard. The forward power meter has a relative accuracy of less than ±5.0W over a display range of 1-100W (CW signal only).

FAULT RESET Push-button

The Fault Reset push-button switch allows faults to be reset if the amplifier is in an operational state. Also, pressing this button will cause RF power output to be turned off. The red LED indicator, marked 'FAULT' and located to the right of the display, will light when a fault occurs.

REMOTE ENABLE Push-button

To use REMOTE ENABLE you must activate the IEEE-488 or RS-232/-422 interface (remote rear panel connection).

To activate the REMOTE ENABLE push-button:

1. Connect the standard 24-pin IEEE-488 connector through the back panel's IEEE-488 Interface port.
2. Verify that DIP Switch Positions A, B, and C are in the down (Logic '0') position.
3. Read and understand all information contained in all sub-sections of Sections 3.2.4 and 3.2.5.
4. Verify that REMOTE ENABLE is enabled by checking that the REMOTE ENABLE push-button LED, located to the right of the AC POWER switch on the front panel, is lit when depressed.

3.1.5 Front Panel Connectors

The following connectors have been provided for system interfacing through the front panel:

- RF Input
- RF Output with Output Load VSWR Protection
- Modulation Input

RF INPUT

The RF INPUT connector provides connection to the driving generator through this female, Type 'N' connector. Input impedance is 50Ω nominal. Typically, 0dBm is required for full rated power output.

No more than +13dBm ($1.0V_{mm}$) should be applied to the RF INPUT port.

RF OUTPUT and OUTPUT Load VSWR Protection

The RF OUTPUT port provides connection of the amplifier system to the load through this female, Type 'N' connector. Output impedance is 50Ω nominal. The RF OUTPUT port is protected into all phases of any load VSWR.

"Caution High RF Voltage"
Indicates that an AC potential of up to 100V may appear between the center pin of the Type 'N' connector and ground. Normal caution should be exercised when working with these voltages.

3.1.5 Front Panel Connectors (Continued)

RF OUTPUT Load VSWR Protection

The 6100L output load VSWR protection circuit is self-correcting as a function of output load VSWR. The circuits will automatically decrease the forward power output as the RF output load VSWR increases beyond a 1.5:1 VSWR. As the load VSWR improves, the VSWR protection system will automatically increase the forward power up to the rated power output of the system. This forward power output as a function of amplifier load VSWR is continuous and instantaneous in both directions. The turndown characteristics are presented in the following table:

RF Output Load VSWR (All Phases)	1.0 - 1.5:1	3.0:1	Infinite
Forward RF Power Output Below Rated Power 100W (+50dBm)	±0.25dB max.	-5dB min. -7dB max.	-10dB min.

The VSWR Turndown Circuits are designed to provide forward power output turndown as shown in the table above with respect to rated RF power output at 100W (+50dBm). For example:

At a reducted power output (ALC On) mode of 20W and a 3.0:1 load VSWR, forward power output turndown will not occur over the 400 to 1000MHz band.

MODULATION INPUT

MODULATION INPUT is provided through this female, type 'BNC' connector. This connection provides AM, pulse and square wave modulation of the internal ALC loop when operating in the ALC 'ON' and modulation 'ON' modes.

Approximately $1V_{rms}$ for a sine wave or 0.8V peak-to-peak for square wave will provide full modulation (see Note, Section 3.1.4.3).

The RF input level at the RF INPUT connector should be set to +7dBm ±1 minimum for minimum modulation distortion.

CAUTION !

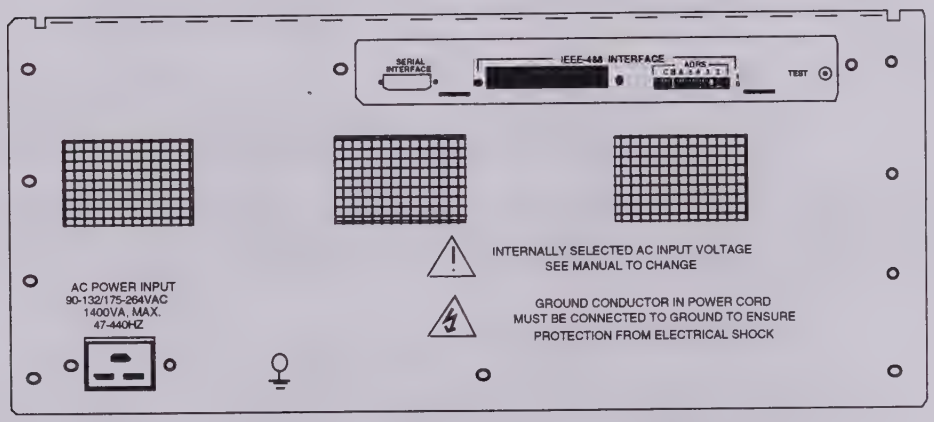
No more than a 2.0Vp-p signal level should be applied to the MODULATION INPUT port.

3.2 Back Panel

The back of the 6100L RF amplifier system contains the following:

Mnemonic Description

Label	Description
AC Power Input	IEC 320 (16A) male connector
⏚	M6 (metric thread)
SERIAL INTERFACE	9-pin female, filtered Type 'D' connector
IEEE-488 INTERFACE	IEEE connector
ADRS (IEEE-488 INTERFACE)	8-position address DIP switch
TEST	Green LED Indicator
▦	Air Vents Exhaust



6100L Back Panel
Figure 3.2

Descriptive text on each of these connections is presented throughout the remainder of this section.

3.2.1 AC POWER INPUT CONNECTOR

This connector is a three-prong IEC 320 (16A) male type plug with safety ground connected to chassis. The amplifier system is designed to operate at either 115VAC or 220VAC. Refer to Section 2.3 for instruction to properly select the AC line voltage.

Be sure that the amplifier is set to the proper line voltage before AC power is applied. Otherwise, damage to the RF amplifier system can occur.

3.2.2 Ground Stud

An M6 metric thread stud provides a chassis ground connection.

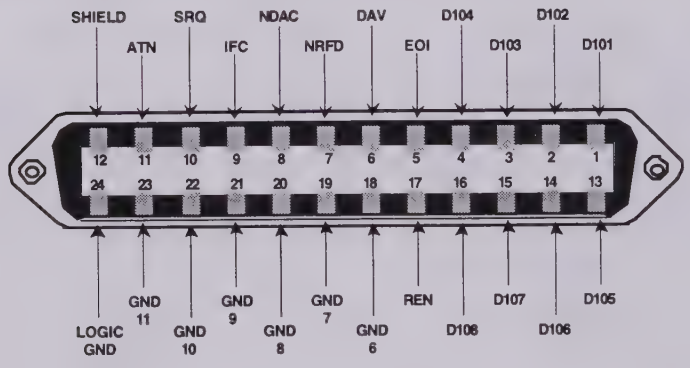
3.2.3 TEST (Indicator)

The green LED indicator, located on the back panel's upper right-hand corner, flashes to indicate that the amplifier's µP (micro-processor) control program is operational. The green LED flashes at approximately one flash per second. The amplifier's front panel controls are non-functional if this LED is not flashing.

3.2.4 IEEE-488 Interface

This interface provides a standard 24-pin IEEE-488 connector and an 8-way DIP switch that allows selection of the IEEE-488 bus address.

Note: *REMOTE ENABLE must be active to implement this command; see Section 3.1.4.6.*



Pinout for IEEE-488 Connector
Figure 3.2.4

DIP Switch

The DIP switch allows selection of the IEEE-488 bus address using the five right-most switches. The address is selected using binary format where a switch in the down position is a logic zero. For instance, the following pattern gives the

IEEE-488 address 23:

Black indicates switch in Logic 0 (down) position.

Note that Address 31 is reserved. If the switches are set for an address of 31 the actual address will be forced to 30.

Note: *Switch Positions A, B and C are reserved and should be left in the down (Logic 0) 4 4 7 7 position.*

3.2.4 IEEE-488 Interface (Continued)

IEEE-488 Command Set

The IEEE-488 interface allows control and monitoring of the amplifier functions using a single letter which is followed by a number (in some cases).

A typical command might be:

P 12.4 EOI

The letter P represents the RF "power" level command. The digits 12.4 represent the required RF power output of the amplifier (ALC 'ON' mode only).

Commands are terminated by the IEEE-488 "EOI" function, at which time the amplifier acts upon them.

Multiple commands may be connected together as follows:

R0 A0 P0 EOI

This causes both RF power (at a power level of zero) and ALC to be turned 'ON'. Spaces are optional and will be ignored when the amplifier scans and activates the command.

Numerical Formats

The IEEE-488 interface follows the IEEE-488.2 specification for data formats.

Power level is entered as an ASCII string of digits with an optional decimal point. If the decimal point is left out the amplifier assumes that the value after the decimal point is zero. For example:

P 12 is the same as P 12.0

Numerical Formats (Continued)

Enabling Power Output (ALC)

The following example shows how to set the ALC mode and to enable a power output of 10.5W. Each command is shown separately for clarity, even though the function can be completed with a single command.

A0 [EOI]	Turns ALC mode on.
P10.5 [EOI]	Sets power to 10.5W.
R0 [EOI]	Turns RF output on.

The single command method is:

A0 P10.5 R0 [EOI]

Reading Forward Power

The following example shows how to read the amplifier's forward power.

D0 [EOI]	Selects forward power for amplifier readback. (Makes amplifier "talk" data back.)

IEEE-488 Command Summary

Command	Action
Z	Initializes the amplifier. This is the same as R0 A0 P0.
P nnn.n	Sets amplifier RF power level to nnn.n Watts if in ALC 'ON' mode.
An	ALC Control: 0 - on 1 - off
Fn	Filter Control: 0 - on 1 - off
Rn	RF Output Control: 0 - on 1 - off
Mn	Modulation Control: 0 - on 1 - off
Wn	Metering Mode Control: 0 - dBm 1 - Watts
Sn (optional)	Relay Control: 0 - Relay 1 off 1 - Relay 1 on 2 - Relay 2 off 3 - Relay 2 on
Dn	Readback Control: 0 - Forward Power 1 - Reverse Power 2 - ALC Condition 3 - Fault Vector 4 - Amplifier Status 5 - Modulation Condition 6 - Set Point Power 7 - Read LoopBack Value
C	Attempt To Clear Faults
L nnnnn	Load LoopBack Value
In	Level A Command 0 - Decrement Set Point 1 - Increment Set Point
En	Level B Command 0 - Remote Enable ON 1 - Remote Enable OFF

IEEE-488 Command Summary
Table 3.2.4.4

ReadBack Formats

The 'D' command allows selection of one of seven parameters for readback from that time onwards. The format of readback data follows the IEEE-488.2 convention. The amplifier uses the floating point, hexadecimal and binary formats:

Floating Point	+012.3
Binary	#B0
Hexadecimal	#H89AB

All readback data is terminated with a new line character (0A) and EOI according to the IEEE-488.2 specification.

Note: *Since the floating point format is used for reporting RF power level, the value will always be positive.*

ReadBack Buffer

Data is read from a special buffer in the 6100L. The buffer is updated with information which was specified by the last 'D' command. The default at power-up is forward power (equivalent to D0).

The buffer is loaded with new data under two circumstances:

- Immediately after any command has been sent to the 6100L (Listen mode).
- Immediately after data has been read from the 6100L (Talk mode).

It is important to observe that information in the readback buffer is as old as the last time data was written to or read from the 6100L. If the 6100L is being constantly monitored this will not be a problem: However, if the monitoring operation is infrequent, reported data will be old unless one of the following is done first:

- Send a command to the 6100L. Dn is recommended where n is the parameter to be monitored.
- Read data from the 6100L and ignore.

LoopBack Value

The loopback function has been incorporated to allow checking of the "talker" and "listener" functions:

In the listen mode a number up to 65535 can be sent to the amplifier.

In the talk mode the number can be retrieved from the amplifier.

The controlling computer can be set up to send and receive the loopback number and check its validity to ensure that the IEEE-488 is functioning properly.

ReadBack Control Summary

The following chart describes the data format that is returned for each of the readback types.

Readback

Type	Function	Format
D0 D1 D6	Forward Power Reverse Power Set Point Power	+nnn.n
D2 D5	ALC Condition MOD Condition	#B0 - on #B1 - off
D3	Fault Vector	#Hnnnn
D4	Amplifier Status	#Hnn
D7	Read LoopBack Value	Whatever was sent by the user.

Fault Vector and Amplifier Status Formats

The fault vector and amplifier status read back data are formatted as four hexadecimal digits. The bits within each digit are formatted as follows:

Fault Vector Format

DIGIT 0	0	RF Overheat
	1	Interlock Open
	2	Spare
	3	Spare
DIGIT 1	4	Spare
	5	Max Reverse Power Fault
	6	Spare
	7	Metering Fault
DIGIT 2	8	Internal (80C552) RAM Fault
	9	External RAM Fault
	A	Code ROM Fault
	B	Spare
DIGIT 3	C	Spare
	D	Link Integrity Timeout
	E	IIC Fault
	F	Watchdog Timeout Fault

Amplifier Status Format

DIGIT 0	0	Remote On
	1	ALC On
	2	Fault
	3	dBm Mode On
DIGIT 1	4	Max Power
	5	RF On
	6	Remote Enable
	7	Modulation On

3.2.5 SERIAL INTERFACE Connector

The serial interface (see Figure 3.2.4) provides control and monitoring of the 6100L amplifier system using standard RS-232 or RS-422 voltage levels in a 7 or 8 bit serial packet. The interface also supports parity and either 1 or 2 stop bits. Data rates may be up to 19.2k baud. Each pin's function is outlined in Table 3.2.5.1 and available selections are defined in Section 3.2.5.1.1.

Hardware Configuration

The 6100L was shipped to you with RS-232 selected. RS-422 operation is selected by the position of four, three-pin jumpers (J4, J5, J8, J9) on the IEEE-488 PCB A3A3. This board contains the circuitry necessary for the μP to connect to the IEEE-488 and RS-232/RS-422 interfaces on the back panel of the amplifier.

A standard, 9-pin female filtered Type 'D' connector provides the electrical connection as defined in Table 3.2.5.1.

Pin	Function	Description
1	Tx Data -	This pin is the - side of the RS-422 Tx data output.
2	TX Data +	This pin provides either the + side of the RS-422 TX data output or the RS-232 Tx data output, depending on jumper P9's position.
3	Rx Data +	This pin provides either the + side of the RS-422 Rx data input or the RS-232 Rx data input, depending on jumper P4's position.
4	Rx Data -	This pin is the - side of the RS-422 Rx data input.
5	Digital Ground	This pin is connected to the digital ground of the controller.
6	CTS -	This pin is the - side of the RS-422 CTS signal input.
7	CTS +	This pin provides either the + side of the RS-422 CTS signal input or the RS-232 CTS signal input, depending on jumper P5's position.
8	RTS +	This pin provides either the + side of the RS-422 RTS signal output or the RS-232 RTS signal output, depending on jumper P8's position.
9	RTS -	This pin is the - side of the RS-422 RTS signal input.

Hardware Configuration for Serial Interface
Table 3.2.5.1

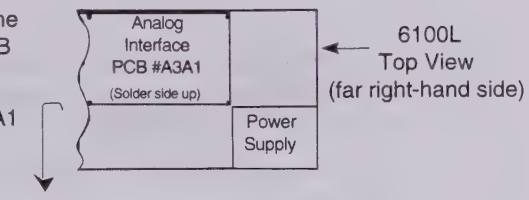
3.2.5 SERIAL INTERFACE Connector (Continued)

The following procedure allows the selection of RS-422 operation:

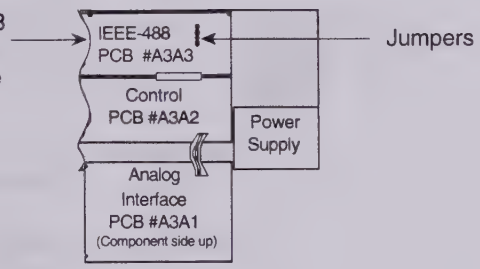
- Ensure that the 6100L is off. Remove the unit's top cover by removing the sixteen screws holding it in place.

- Remove the four screws from the corners of Analog Interface PCB #A3A1.

- Flip Analog Interface PCB #A3A1 toward the front of the unit.

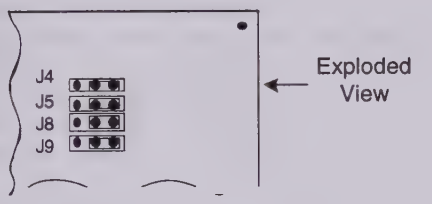


- Directly below, locate IEEE-488 PCB #A3A3. The jumpers are approximately 1½" from the side panel.



- Slide all four jumpers to the far right to enable RS-422 operation.

Example:
RS-232 Selected
RS-422 Selected



- Reposition the Analog Interface board, tightening it down with the four corner screws. Return the top cover to its original position and resecure it with the sixteen screws.

This completes the procedure.

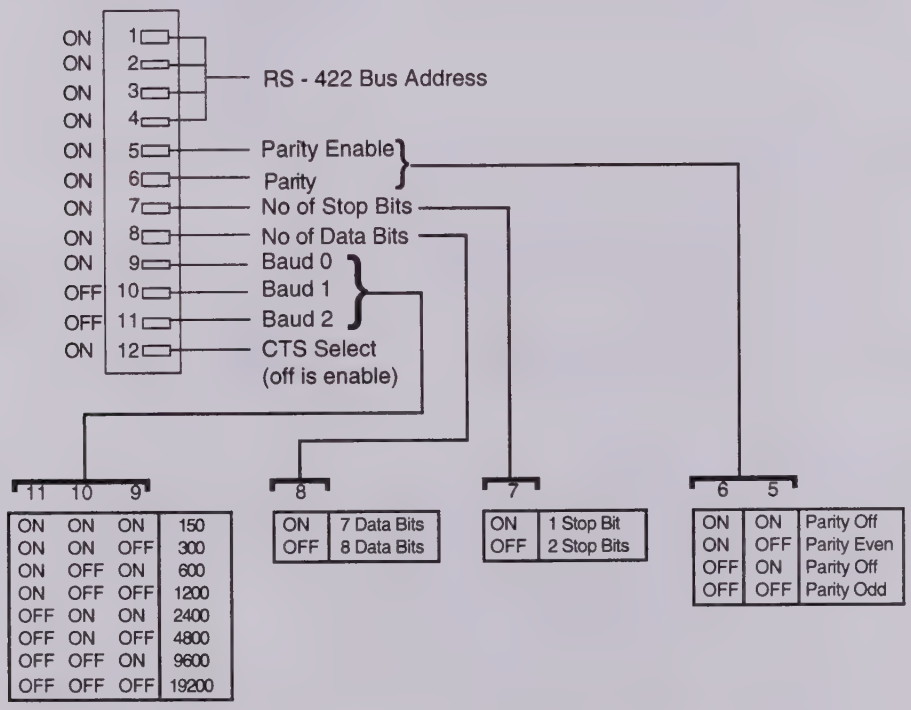
Serial Remote Control Selections

Control PCB A3A2 (part of Control Section Assembly A3) contains one 12-way DIP switch which selects the function of the serial interface. The first four positions select the serial bus address and the remaining eight positions select baud rate and serial data format.

The DIP switch is only read when the power is turned on. It is necessary to remove and reapply power before the new setting can be used by the controller.

Note: *Serial configurations RX of 7 data, 1 stop, no parity and TX of 8 data, 2 stop, parity are not available.*

The DIP switches, located on Control PCB A3A2, are configured as follows:



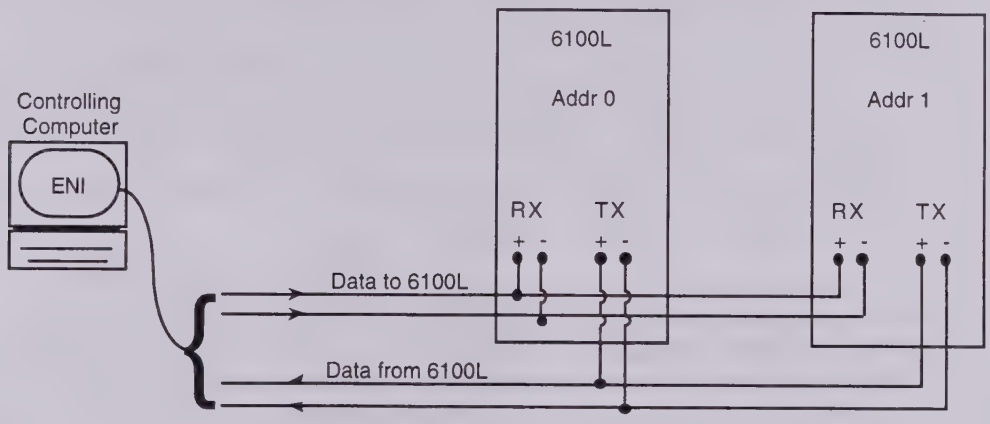
Serial Remote Control Selections
Table 3.2.5.1.1

When a switch is set to the ON condition (marked on switch case) the logic level is '0'. For instance, to set the RS-422 bus address to 5, turn on switches 2 and 4 and turn off switches 1 and 3. This generates the code 0101 or 5 in hexadecimal format.

Verify that the bus address is set to 0000 for RS-232 operation.

RS-422 Bussing

One controlling computer or terminal can be connected to more than one 6100L Amplifier System by connecting RS-422 receive and transmit data lines in parallel as shown in the following diagram



RS-422 Bussing
Figure 3.2.5.1.2

When this mode of operation is used it is necessary to use the IDE command and link release character as described in Sections 3.2.5.3 and 3.2.5.2.8, respectively.

3.2.6 Communication Protocol

Data is transferred to and from the CPU (located on Control PCB A3A2) using a simple ASCII protocol which functions with a standard terminal.

All commands are composed of three ASCII characters followed by numbers, where applicable, and terminated by a carriage return. All three command characters must be correct for a command to be accepted. Since all characters including the watchdog character are echoed, the main controller can check that commands were correctly received by comparing the echoed characters with what was sent.

Commands containing numerical fields will only be accepted if the numerical portion is in a specified range.

Upon receipt of a carriage return (0D) the controller returns a carriage return and a line feed (0A) so that the terminal screen is correctly formatted. In addition, an asterisk (*) is used to indicate that the command has been accepted and executed. If a bad command is received a question mark (?) and bell character (07) are returned instead. The response is ordered as follows:

[CR] [LF] [*]
or
[CR] [LF] [BELL] [?]

The protocol always returns one of these two responses after command execution. In addition, there are no unprompted responses with the exception of the power-up message.

The following commands illustrate the types of messages that are available and accompanying formats:

HEL	n	Causes a help screen to print. The required screen number is n.
RFV		Causes a 16 bit fault vector to be reported, showing the system's health.
RUT		Causes total on time of the unit to be reported.

Space Characters

To allow screen formatting, space characters (20) are ignored. However, when they are received, they are returned on the serial link in the same way as any other character.

Illegal Commands

Unrecognized commands or out-of-range numerical values are ignored and enunciated by the return of a question mark character and a bell character. The same response occurs if the limits of the line buffer are exceeded (16 characters). Note that a carriage return on its own is a valid command that does nothing (no operation).

Leading Zeros

The numerical part of the field sent by the terminal need not contain leading zeros although leading zeros will be echoed and accepted if they are sent. If a numerical field is empty it is assumed to be zero.

Special Characters

Five characters have a special purpose and are the only characters not echoed on the serial link. The escape character allows the operator to break out of continuous loops. The ^W (control W) character is used to maintain link integrity. The exclamation mark (!) is used to cause an immediate release of the RS-422 buffer if two consecutive exclamation marks are received in a row. The XON and XOFF characters ,^Q and ^S, allow flow control out of the transmit serial port.

Link Integrity (Line Time-Off)

This function is disabled when power is applied.

Upon receipt of the first ^W character the link integrity function is enabled and a ^W must be received at the rate of one per second (or less). Otherwise, a link timeout fault will be generated and power output will be disabled.

Power-Up Message

Power-up is enunciated by a message terminated by a special prompt, an asterisk enclosed in curly brackets {*}. This is the only time that this prompt is used. Therefore, a controlling computer can use this to see that a unit has been powered up. The complete power-up string is as follows:

[CR] [LF] [message string] [CR] [LF] [BELL] [{] [*] [}]

Backspace Characters

Backspace or delete characters (ASCII 08 or 7F) allow limited editing. When one of these characters is received, the last character in the line buffer is deleted and the following three characters are returned:

[BS] [SPACE] [BS]

This ensures that a terminal screen backspaces its cursor and removes the last character.

Escape From Indefinite Loops

Some commands continue indefinitely. For example, the DOS command when used with the dash option. The escape character is used to exit from this condition. Upon receipt of the escape character the controller will terminate the loop and respond with the standard command completion string:

[CR] [LF] [*]

Link Release Character

When two exclamation marks are received immediately after one another the controller immediately tri-states the RS-422 output. Collisions are thus avoided on the RS-422 bus if multiple controllers are being used. The correct way to switch from one controller to another is to execute a link release (!!) and then use the IDE command to select the new controller. The IDE command will work on its own but will occasionally suffer from a collision when the old controller does not release before the new controller takes over.

XON and XOFF

When XOFF (^S) is received, transmission of serial data is halted. When XON (^Q) Is received, transmission of serial data is restarted.

User Commands

6100L amplifier system's specific user commands are grouped into the following four categories:

Commands:

- Basic Monitor
- Direct Control
- ReadBack
- Level A Extra

Basic Monitor Commands

The basic monitor commands allow the user limited access to the controller software. They are intended for servicing and fault finding.

Command		Function
HEL	<n>	Decimal values of n from 0 to 9 display each of the ten possible help screens. Values between A and F will show help screen 0. Values greater than sixteen show help screen 0.
CHK	<Addr> - <Addr>	This command calculates the checksum of the program memory range specified. The address may be in the range 0 to FFFF. The checksum is a simple additive type where each byte in the specified range is added to the next. If a range 0-FFFD is specified the least significant two bytes will be the same as the internal checksum of the EPROM stored in locations FFFE and FFFF.
IDE	<Ident>	The Ident may have values from 0-255. However, the controller can only be enabled with values of 0-15 since it only has four switches for address selection. All other values will cause the controller to be disabled. This command works in association with the ident DIP switch. When the ident in the command is the same as the ident on the DIP switch it is possible to communicate with the controller. If the idents do not match communication is disabled. This command is designed to work with the RS-422 port only since the output buffer can be tri-stated, allowing a bus to be formed with multiple amplifiers. The RS-232 port cannot be tri-stated.

Basic Monitor Command Selections
Table 3.2.5.3a

Note: *See also, Link Release Character in Section 3.2.5.2.8, and RS-422 bussing in Section 3.2.5.1.2.*

ReadBack Commands

The following commands are known as passive commands. They simply read back a value or status.

Command		Function
ACT	<->	Returns three power read-back values and the system status vector in the following format: (Forward Power)(Reverse Power)(Set Point Power)(Status Vector) Data will be read back continuously if the optional dash is used until the escape character is received.
REP	<->	Prints out the Name, Date, and Serial Number information.
ROF		Returns the metered forward power in Watts using decimal format.
ROR		Returns the metered reverse power in Watts using decimal format.
ROT		Returns the number of hours that the 6100L has had RF turned on.
RSE		Allows the power set point loaded by the PWR command to be read back for verification purposes.
RUT		Returns the total time that the 6100L has been turned on in hours.
RVE		Returns the version number of the software. Numbers in front of the decimal point denote a major software revision while numbers after the decimal point denote a minor software revision.
RPC		Returns the amplifier conditions in the form of two ASCII hexadecimal digits. These two digits contain an 8-bit value with each bit defined as follows:

DIGIT 0	0	ALC loop is in a leveled condition
	1	Modulation is present
	2	Spare
	3	Spare
DIGIT 1	4	Spare
	5	Spare
	6	Spare
	7	Spare

Readback Command Selections
Part One of Table 3.2.5.3.2

<table>
<tr><th>Command</th><th>Option</th><th>Function</th></tr>
<tr><td>RFV</td><td><=></td><td>Returns a 16 bit value called the fault vector and is formatted as four hexadecimal digits. RFV <=> lists all errors in a word format so that interpretation of hexadecimal is not necessary if the equal option is used. Bits in the fault vector are positioned as follows:

DIGIT 0
0 RF Overheat
1 Interlock Open
2 Spare
3 Spare

DIGIT 1
4 Spare
5 Max Reverse Power Fault
6 Spare
7 Metering Fault

DIGIT 2
8 Internal (80C552) RAM Fault
9 External RAM Fault
A Code ROM Fault
B Spare

DIGIT 3
C Spare
D Link Integrity Timeout
E IIC Fault
F Watchdog Timeout Fault</td></tr>
<tr><td>RPS</td><td></td><td>Returns the amplifier status and is formatted with two ASCII hexadecimal digits. The two digits represent 8 status bits as follows:

DIGIT 0
0 Remote On
1 ALC On
2 Fault
3 dBm Mode On

DIGIT 1
4 Max Power
5 RF On
6 Remote Enable
7 Modulation On</td></tr>
</table>

Readback Command Selections

Part Two of Table 3.2.5.3.2

Direct Control Commands

The following commands cause an immediate change to the system. Please denote the following before employing any command:

1. The controller will respond with a question mark (?) for the following commands when an out-of-range value is specified.
2. In-range values will be responded to with an asterisk (*) when the command has been successfully completed.
3. Excluding the BUT <n> command, each command is inoperative when the amplifier is in remote mode (REMOTE LED lit). Read BUT <n> carefully to ascertain its unique difference in command response format.

All Direct Control commands are outlined in Table 3.2.5.3.3 on the following page.

Note: *Remember, if any of the commands presented in Table 3.2.5.3.3 are selected, a ? is returned to indicate out-of-range value errors while an * denotes in-range values and the successful completion of any command.*

Level A Extra Commands

The following commands are available after using the KEY <code> command. If the correct code is entered (code available from factory) these commands may be used until power is removed and reapplied or an invalid key code is entered.

Command	Function
CAL	This command allows calibration of the MAX thresholds, metering, and front panel Set Point control. When CAL is typed a menu is displayed.
FFI	This command allows fault finding within the amplifier. Typing FFI displays the menu.
XRT	This command tests the external RAM. If the RAM is good, a message of [PASS] is returned; if the RAM is bad a message of [FAIL] is returned.

Level A Extra Command Selections
Table 3.2.5.3.4

Command	Function
LIT	Disables the link integrity function. See Section 3.2.5.2.4, *Link Integrity.*
PWR <POWER>	Allows the power set point to be changed. The power is entered in decimal Watts between 0 and 36.0.
OFF	Turns RF power off.
TRG	Turns RF power on at the power level selected by the PWR command.
BUT <n>	Does the same as the front panel buttons. The value n selects the button to be pressed while 1 selects the top left button, 2 selects the button below it, 3 selects the next top left button over and so on. If the amplifier is in remote mode (remote lamp lit) the command only allows the remote enable button to be activated. This command always returns a * for valid buttons, irrespective of remote mode.
FRE	Causes all fault status bits in the system to be cleared as long as the actual faults have cleared.
REM <Type>	Remote mode select control. REMOTE ENABLE light must be on to enter Remote mode. 0 = Local 1 = Remote
ALC <Type>	ALC mode control. Must be in Remote mode. 0 = off 1 = on
MOD <Type>	Modulation mode control. Must be in ALC mode to enable Modulation mode and must be in Remote. 0 = off 1 = on
DBM <Type>	Power units control. Selects the type of units that are displayed on the front panel pertaining to POWER. Must be in Remote mode. 0 = off 1 = dBm
FLT <Type>	Controls the Low-Pass Filters in the Forward and Reverse metering paths. Must be in Remote mode. 0 = No Filtering 1 = Filtering
RLA <Type>	Relay #1 Control Must be in Remote Mode. 0 = off 1 = on
RLB <Type>	Relay #2 Control Must be in Remote mode. 0 = off 1 = on

IPO <Type>	Increments Power Set Point. 0 or no argument will result in an increase of 1. A value of 1 will result in an increase of 2. Add one to the size to get the amount of increase. This command accepts a two digit hexadecimal value ranging from 0-FE yielding results in decimal of 1-255. This command will not function if the unit is in Remote mode. If RF is on this command will adjust the Set Point and automatically adjust the output power level to it. It is not necessary to use the 'TRG' command. Resolution = four increments to adjust .1W up.
DPO <Type>	Decrements Power Set Point. Uses the same format as IPO but decreases the Power Set Point. Resolution = four increments to adjust .1W down.

Direct Control Command Selections
Table 3.2.5.3.3

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6100L Specifications

Class of Operation	Class AB
Rated RF Power	400 to 1000MHz, instantaneous
Frequency	100W (+50dBm) nominal (ALC Off or On: Front panel knob in position of maximum clockwise rotation.)
Power Output Flatness	±0.5dB up to rated power for input of -3dBm to +8.0dBm (ALC On)
Harmonic Distortion	-20dBc minimum at rated power output for RF input up to +8dBm (ALC Off or On: Front panel knob in position of maximum clockwise rotation.)
Small Signal Gain	50dB minimum; 51dB nominal
Small Signal Gain Flatness	±2.0dB maximum (ALC Off) at RF power output equals 10.0W maximum
Noise Figure	14dB maximum
Load Impedance for Ratings	50Ω nominal at 1.5:1 VSWR maximum
RF Input/Output VSWR	3.0:1 maximum input; 2.0:1 maximum output
RF Input Overdrive Limit	+13dBm or 1Vrms maximum for RF input frequency of 1.0MHz to 1300MHz
RF Input Modulation Formats	(ALC Off)
	AM Modulation Bandwidth: Limited by RF bandwidth
	AM Modulation Distortion: 10% maximum at 100W PEP (Peak Envelope Power)
	FM Modulation Bandwidth: Limited by RF bandwidth
	Pulse Modulation: 50 nanoseconds typical rise/fall time maximum
Power Level Control Range	30dB minimum (ALC On)
RF Stability	Unconditional
Protection	Fully protected against out-of-band operation, overdrive, output load VSWR and overtemperature
Spurious Output	-60dBc minimum
Modulation Input Impedance	600Ω, ±5%
Modulation Input Level	0.8V peak sine wave maximum for rated AM modulation (ALC On)

Modulation Input Polarity

DC coupled; positive DC voltage of +0.8V typical, results in a RF power output level of 100W.

Modulation Input Overdrive

2.0V peak pulse input; 2.0Vp-p sine wave input limit

Modulation Formats

(ALC On)

Square wave Modulation 1000Hz

AM Modulation	DC to 25kHz at -3dB, 80% depth of modulation, typical DC to 20kHz at -3dB, 80% depth of modulation, minimum.
Pulse Modulation	50µs rise/fall time, typical; 75µs rise/fall time maximum (Typical is defined as 75% of all modulation bandwidth and rise/fall readings meeting specification.)

Primary AC Power Input

Voltage	90 to 132/175 to 264VAC (Internally Selected)
Frequency	47 to 440Hz
Power	1400VA maximum, single phase

Display Type

Alphanumeric vacuum fluorescent

Power Indicator

Indicates forward and reverse RF power output in Watts (or dBm) with an accuracy (with respect to a Hewlett Packard Digital Power Meter #HP 437B and Power Sensor #HP 8482B at 85 ±2.0W level) of ±5.0W typical, ±1.5W maximum over the specified frequency range and temperature 25±10°C ambient or ±5.0W typical, ±3.0W maximum over the specified frequency range and +0°C to +45°C ambient temperature range. (Typical is defined as 75% of all power readings meeting specification).

Power Indicator Filter

A low-pass filter under remote interface control only will change the forward and reverse power meter from an average to a peak responding meter. This significantly increases the speed at which forward and reverse power meter data reading can be made.

Environmental

Operating Temperature	0° to 45°C ambient
Non-operating Temperature	-40°C to 85°C ambient
Altitude	10, 000 feet
Humidity	96% relative without condensation

Cooling System

Forced air; front panel in, rear panel out

Front Panel Controls	AC Power Switch, RF Power Level Knob, ALC On/Off, RF On/Off, Modulation On/Off, Fault Reset, Watts/dBm, Remote Enable	
Front Panel Indicators	Indicator LEDs	FAULT(red), REMOTE (green), RF ON (green)
	Push-button/LEDs	ALC, ON/OFF (RF On/Off), FAULT RESET, MOD (Modulation), WATTS/dBm, REMOTE ENABLE
	Display	Forward, Reflected, Set Point Power (Watts or dBm), Status and Operating Faults
Front Panel Connectors	Type 'N' female RF Input/Output, Type 'BNC' female Modulation Input	
Rear Panel Connectors	AC Input: IEC 320 (16A) male	
Rear Panel Ground Stud	M6 (metric) thread	
Rear Panel Interface	IEEE-488 Interface Connector and Address Switch	
RS-232/422 Serial Interface	9-pin female filtered 'D' connector	
Rear Panel Indicator	Test LED (green)	
Rear Panel Connectors	Type 'N' female RF input/output (all options). Type 'BNC' female Modulation Input	
Rack-Mounting Options	19" EIA rack-mounting brackets 19" EIA rack-mounting slides JIS rack-mounting	
Size ***(H x W x D)***	7.0 x 16.6 x 24.4 nominal *17.7 x 42.0 x 61.8 cm* *(Dimensions exclusive of handles, connectors and feet)*	
Weight:	55 lbs. nominal *(24.7kg)*	

Glossary of Abbreviations

A	Amperes
AMP	Amperes
ASSY	Assembly
BR	Bridge
CAP	Capacitor
CER	Ceramic
DESIG	Designation
ELECT	Electrolytic
FWD	Forward
IC	Integrated Circuit
K	Kilohms
kΩ	Kilohms
mV	Millivolts
pF	Picofarad
PIV	Peak Inverse Power
PWR	Power
POT	Potentiometer
REF	Reference
REQ	Required
RFL	Reflected
RES	Resistor
S.B.	Slow Blow
uF	Microfarad
µF	Microfarad
uH	Microhenry
µH	Microhenry
V	Volts
VDCW	DC Working Voltage
W	Watts
WW	Wire Wound

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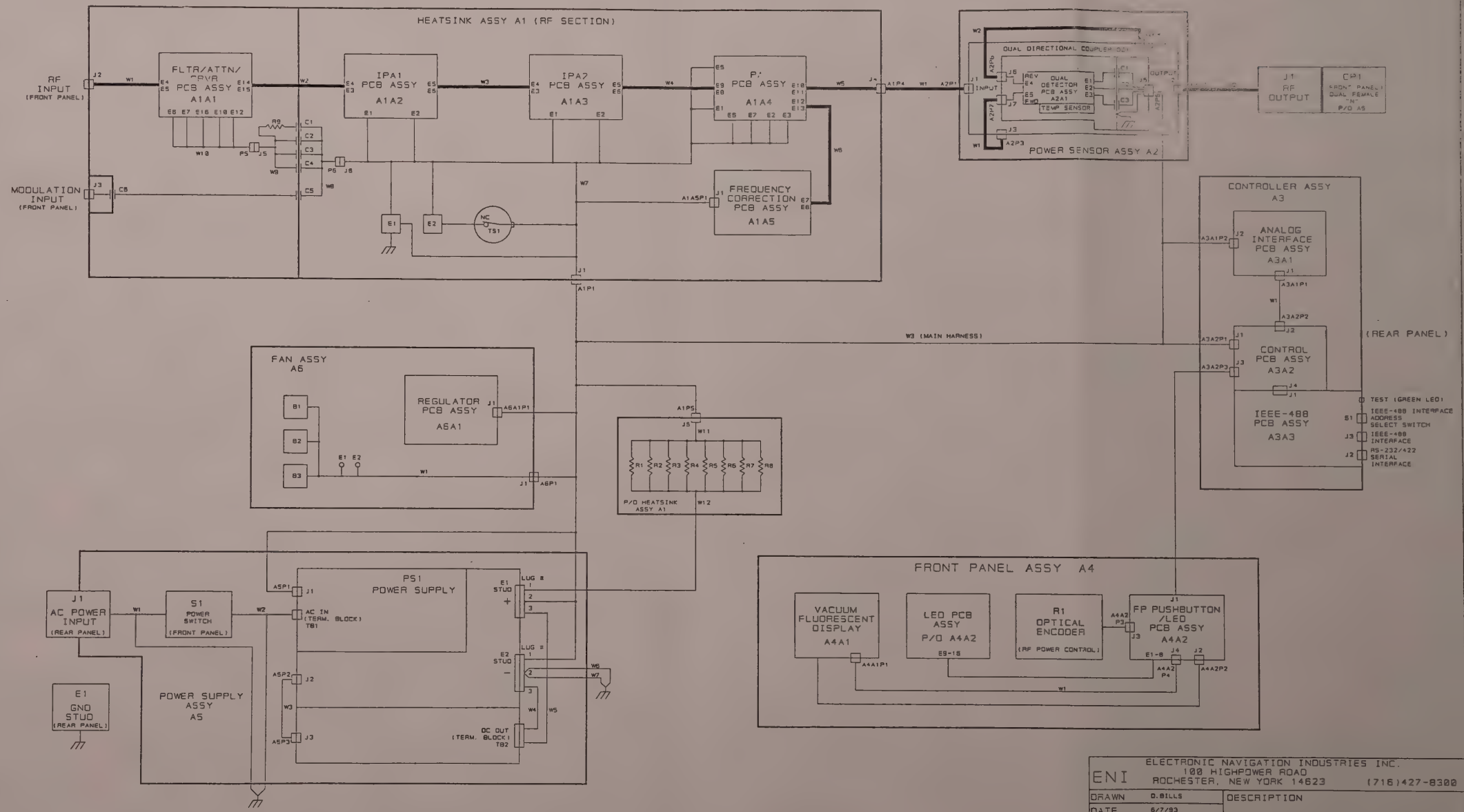
HEATSINK ASSY A1 (RF SECTION)
RF INPUT (FRONT PANEL)
FLTR/ATTN/ CPLR PCB ASSY A1A1
IPA1 PCB ASSY A1A2
IPA2 PCB ASSY A1A3
P. PCB ASSY A1A4
MODULATION INPUT (FRONT PANEL)
FREQUENCY CORRECTION PCB ASSY A1A5
DUAL DIRECTIONAL COUPLER
DUAL DETECTOR PCB ASSY A2A1
TEMP SENSOR
POWER SENSOR ASSY A2
J1 RF OUTPUT
CP1 (FRONT PANEL) DUAL FEMALE "N" P/O A5
CONTROLLER ASSY A3
ANALOG INTERFACE PCB ASSY A3A1
CONTROL PCB ASSY A3A2
IEEE-488 PCB ASSY A3A3
(REAR PANEL)
TEST (GREEN LED)
IEEE-488 INTERFACE ADDRESS SELECT SWITCH
IEEE-488 INTERFACE
RS-232/422 SERIAL INTERFACE
W3 (MAIN HARNESS)
FAN ASSY A6
REGULATOR PCB ASSY A6A1
P/O HEATSINK ASSY A1
J1 AC POWER INPUT (REAR PANEL)
S1 POWER SWITCH (FRONT PANEL)
E1 GND STUD (REAR PANEL)
POWER SUPPLY ASSY A5
PS1 POWER SUPPLY
AC IN (TERM. BLOCK) TB1
DC OUT (TERM. BLOCK) TB2
FRONT PANEL ASSY A4
VACUUM FLUORESCENT DISPLAY A4A1
LED PCB ASSY P/O A4A2
R1 OPTICAL ENCODER (RF POWER CONTROL)
FP PUSHBUTTON /LED PCB ASSY A4A2

	ELECTRONIC NAVIGATION INDUSTRIES INC. 100 HIGHPOWER ROAD ROCHESTER, NEW YORK 14623 (716)427-8300	
ENI	DRAWN D.BILLS	DESCRIPTION: 6100L SYSTEM BLOCK DIAGRAM
	DATE 6/7/93	
	DESIGN D.BILLS	
	DEV. [signature] 1/28/94	DWG. NO. 1020-976 REV B
	CHECK [signature] 1/28/94	
	APPROVAL [signature] 1/28/94	
	FILENAME: 20976001.CSD	SHEET 1 OF 1

REV	DESCRIPTION	DATE	CHK	APPV
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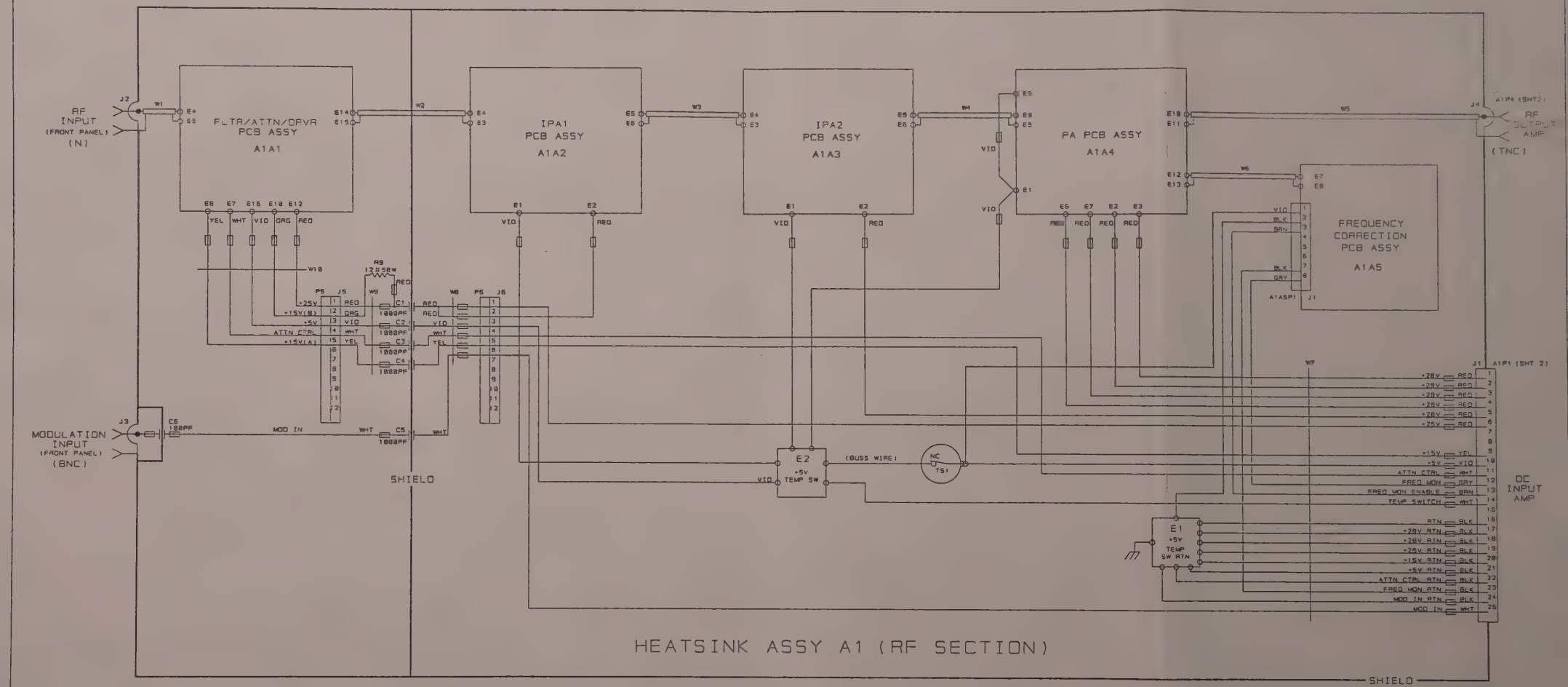

HEATSINK ASSY A1 (RF SECTION)

REV	DESCRIPTION	DATE	CHK	APPV
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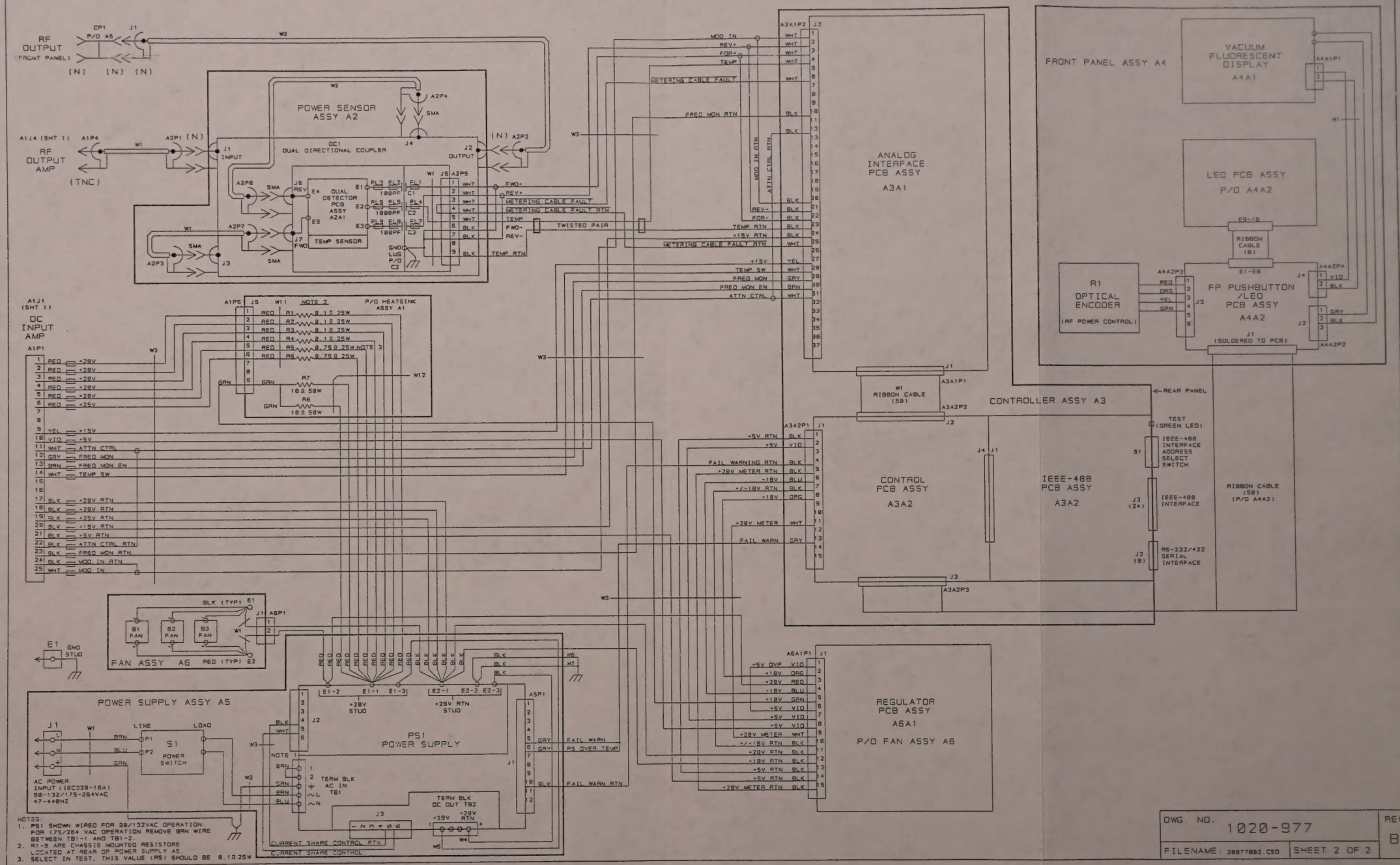
ELECTRONIC NAVIGATION INDUSTRIES INC.
100 HIGHPOWER ROAD
ROCHESTER, NEW YORK 14623 (716)427-8300

DRAWN	D.BILLS
DATE	5/28/93
DESIGN	D.BILLS
DEV	1/28/94
CHECK	1/28/94
APPROVAL	1/28/94
FILENAME:	28577B01 ISO

DESCRIPTION: 6100L SYSTEM INTERCONNECT DIA

DWG. NO. 1020-977 REV B

SHEET 1 OF 2


RF OUTPUT (FRONT PANEL)
POWER SENSOR ASSY A2
DUAL DIRECTIONAL COUPLER
RF OUTPUT AMP
(TNC)
TEMP SENSOR
TWISTED PAIR
ANALOG INTERFACE PCB ASSY A3A1
FRONT PANEL ASSY A4
VACUUM FLUORESCENT DISPLAY A4A1
LED PCB ASSY P/O A4A2
R1 OPTICAL ENCODER (RF POWER CONTROL)
FP PUSHBUTTON /LED PCB ASSY A4A2
RIBBON CABLE (8)
(SOLDERED TO PCB)
DC INPUT AMP
P/O HEATSINK ASSY A1
CONTROLLER ASSY A3
REAR PANEL
CONTROL PCB ASSY A3A2
IEEE-488 PCB ASSY A3A2
TEST (GREEN LED)
IEEE-488 INTERFACE ADDRESS SELECT SWITCH
IEEE-488 INTERFACE
RS-232/422 SERIAL INTERFACE
RIBBON CABLE (50) (P/O A4A2)
FAN ASSY A6
POWER SUPPLY ASSY A5
PS1 POWER SUPPLY
REGULATOR PCB ASSY A6A1
P/O FAN ASSY A6
AC POWER (INPUT (IEC320-16A) 88-132/175-264VAC 47-440HZ
POWER SWITCH
TERM BLK AC IN T81
TERM BLK DC OUT T82
CURRENT SHARE CONTROL RTN
CURRENT SHARE CONTROL
NOTES:
1. PS1 SHOWN WIRED FOR 88/132VAC OPERATION. FOR 175/264 VAC OPERATION REMOVE BRN WIRE BETWEEN TB1-1 AND TB1-2.
2. R1-8 ARE CHASSIS MOUNTED RESISTORS LOCATED AT REAR OF POWER SUPPLY A5.
3. SELECT IN TEST. THIS VALUE (R5) SHOULD BE 0.1Ω 25W

DWG. NO. 1020-977	REV B
FILENAME: 20977882.CSD	SHEET 2 OF 2

Glossary of Abbreviations

A	Amperes
AMP	Amperes
ASSY	Assembly
BR	Bridge
CAP	Capacitor
CER	Ceramic
DESIG	Designation
ELECT	Electrolytic
FWD	Forward
IC	Integrated Circuit
K	Kilohms
kΩ	Kilohms
mV	Millivolts
pF	Picofarad
PIV	Peak Inverse Voltage
PWR	Power
POT	Potentiometer
REF	Reference
REQ	Required
RFL	Reflected
RES	Resistor
S.B.	Slow Blow
uF	Microfarad
µF	Microfarad
uH	Microhenry
µH	Microhenry
V	Volts
VDCW	DC Working Voltage
W	Watts
WW	Wire Wound

MP MASTER
MA30553